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COOPERATIVE SWEET SORGHUM VARIETY TESTS FOR SUGAR DURING 1971 IN THREE SOUTHERN STATES

By Kelly C. Freeman, Dempsey M. Broadhead, and Natale Zummo[1]

SUMMARY

Nine varieties of sweet sorghum, *Sorghum bicolor* (L.) Moench, were evaluated for potential sugar production at one or more locations. 'Mer. 69-13' and 'Mer. 68-2' exceeded 'Rio', the standard variety, in Brix in all seven tests. 'Mer. 69-13' (in seven tests) and 'Mer. 68-2' (in six tests) exceeded 'Rio' in sugar yield per acre.

Diseases of economic importance were gray leaf spot in Louisiana and Mississippi, zonate leaf spot in Louisiana, and rough spot infection in Mississippi.

INTRODUCTION

Increasing world demand for sugar dictates the need for a continuous search for crops with sugar-producing potential. Sweet sorghum, *Sorghum bicolor* (L.) Moench, exhibits a high efficiency in sugar production.

Experimental plots designed to test nine sweet sorghum varieties for sugar were planted in three Southern States—Louisiana, Mississippi, and Texas. The varieties tested were 'Rio' (the standard), 'Mer. 69-12', 'Mer. 69-15', 'Mer. 68-1', 'Mer. 68-2', 'Mer. 69-11', and 'Mer. 69-13'. The varieties 'Roma' and 'Mer. 65-2' were tested exclusively at Weslaco, Tex.

METHODS

A randomized complete-block design with four or five replications of each variety was used. Each plot included three rows within an area of 0.02 acre. The seed in most tests were planted with hill-drop planters, with hills two feet apart in the drill, and the plants were thinned to three or four per hill. In the remaining tests, the seed were drilled with a spout drill, and the plants were thinned to 6- to 8-inch spacing. The plots were cultivated with conventional tractor cultivators for weed control.

At harvest, all stalks from the center row of each plot were weighed to determine gross yield. A 10- to 30-stalk sample was taken at random and then weighed, stripped of leaves, topped, and reweighed to determine the net tons of millable stalks per acre.

This sample also provided a mill sample to obtain juice for Brix and sucrose analyses. At Meridian, Miss.; Houma, La.; and Weslaco, Tex., where milling equipment was available, the stalks were harvested and milled the same day. The stalk samples from Baton Rouge and Bossier City, La., and from Lorman, Mississippi State, and Stoneville, Miss., were milled within 24 hours after harvest. The juice from all samples was analyzed immediately after milling except at Weslaco, Tex., where the juice was quick-frozen and analyzed later.

RESULTS AND DISCUSSION

Table 1 shows yield of stripped stalks. 'Rio', the standard variety, averaged 16.4 tons of stalks per acre and ranged from 9.6 to 24.0 tons. 'Mer. 68-1' exceeded 'Rio' in stalk yield in six tests and 'Mer. 69-13' exceeded 'Rio' stalk yield in five tests. 'Roma' and 'Mer. 65-2' stalk yields were 115 and 112 percent of 'Rio' yield at Weslaco.

Table 2 shows degrees Brix of extracted juice. 'Rio' juice averaged 19.5 Brix. 'Mer. 68-2', 'Mer. 69-11', and 'Mer. 69-13' had higher Brix readings than 'Rio'. 'Mer. 69-12' and 'Mer. 69-15' averaged 107 and 104 percent of 'Rio' Brix and compared favorably with 'Rio' in all tests. Hurricane winds before harvest adversely affected sugar development in the late-maturing varieties 'Roma' and 'Mer. 65-2'; these had Brix readings of 90 and 87 percent of 'Rio' Brix, respectively, at Weslaco.

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Sucrose as a percentage of 'Rio' yield is presented in table 3. 'Rio' ranged from 13 to 16.6 percent sucrose and averaged 14.8 percent. In five tests, none of the experimental selections was significantly superior in sucrose yield to 'Rio'. 'Mer. 68-2', 'Mer. 69-11', and 'Mer. 69-12' exceeded 'Rio' in sucrose at Lorman. All the test varieties except 'Mer. 69-11' were superior to 'Rio' in sucrose at Meridian. 'Roma' and 'Mer. 65-2' were significantly lower than 'Rio' in sucrose yield.

In the sucrose purity tests (table 4) none of the test varieties was significantly superior to 'Rio' at any location except Meridian, where 'Mer. 68-1', 'Mer. 68-2', 'Mer. 69-13', and 'Mer. 69-15' were superior in sucrose purity.

Table 5 shows calculated sugar per ton of stalks. 'Rio' averaged 203 pounds of sugar per ton of stalks and ranged from 166 to 233 pounds per ton. 'Mer. 68-2' surpassed 'Rio' in sugar yield in seven tests. 'Mer. 69-11' and 'Mer. 69-13' exceeded 'Rio' sugar yield in six of seven tests.

Table 6 gives calculated sugar per acre. 'Mer. 69-13' exceeded 'Rio' in sugar yield per acre at seven test locations, and 'Mer. 68-2' exceeded 'Rio' at six locations. 'Rio' averaged 3,296 pounds of sugar per acre. Climatic conditions were so diverse that 'Rio' sugar yield varied from 2,008 to 4,613 pounds of sugar per acre. Excessive rainfall at Mississippi State in May and June (total 12.88 inches; excess 6.06 inches) caused poor plant development and low stalk yield.

Table 7 shows the number of days from planting to harvest. 'Rio' averaged 128 days to maturity and ranged from 83 to 155 days.

Table 8 contains data on diseases of economic importance. Disease effects were evaluated on reductions in plant yield and quality and on percentage of leaf destruction.

Gray leaf spot infection was heavy at Baton Rouge, and zonate leaf spot was severe at Houma on the same varieties. Rough spot infection was heavy in six varieties at Lorman and in three varieties at Meridian. 'Rio', 'Roma', 'Mer. 65-2', and 'Mer. 69-13' were resistant to rust infection. 'Rio', 'Mer. 69-15,' 'Roma', and 'Mer. 65-2' showed symptoms of leaf injury to insecticides at Weslaco.

TABLE 1.—*Stripped stalk yields*

Location	'Rio' (tons/acre)	Pct of 'Rio'								LSD at—	
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'	0.05 level	0.01 level
LOUISIANA:											
Baton Rouge	22.7	96	100	91	76	115	94	...	...	10.5	14.4
Bossier City	12.0	126	103	74	60	94	85	...	...	15.1	20.7
Houma	12.1	119	88	94	71	120	84	...	...	28.7	NS
MISSISSIPPI:											
Lorman	11.8	101	92	86	74	108	95	...	...	14.2	19.5
Meridian	24.0	111	107	86	65	111	88	...	...	20.8	28.5
Mississippi State	9.6	113	125	88	75	121	89	...	...	29.3	NS
Stoneville	21.8	125	93	86	73	96	87	...	...	16.4	22.4
TEXAS:											
Weslaco	17.6	...	...	...	85	...	87	115	112	14.9	20.6
Mean	16.4	113	101	86	72	109	88	115	112	....	....

LSD Least significant difference. NS Not significant.

TABLE 2.—*Juice analysis: Brix*

Location	'Rio'	Pct of 'Rio'								LSD at—	
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'	0.05 level	0.01 level
LOUISIANA:											
Baton Rouge	19.0	94	113	106	111	106	103	. . .	. . .	11.6	NS
Bossier City	21.0	102	110	101	98	105	99	. . .	. . .	NS	. . .
Houma	17.8	79	103	104	104	113	104	. . .	. . .	5.4	7.4
MISSISSIPPI:											
Lorman	18.7	104	123	124	126	118	117	. . .	. . .	4.5	6.2
Meridian	19.0	100	107	101	108	102	111	. . .	. . .	5.4	7.4
Mississippi State	19.8	99	105	102	104	102	102	. . .	. . .	NS	. . .
Stoneville	20.4	94	107	103	101	105	102	. . .	. . .	NS	. . .
TEXAS:											
Weslaco	20.5	. . .	. . .	. . .	102	. . .	98	90	87	5.0	6.9
Mean	19.5	96	110	106	107	107	104	90	87	. . .	. . .

LSD Least significant difference. NS Not significant.

TABLE 3.—*Juice analysis: Sucrose content*

Location	'Rio' (pct)	Pct of 'Rio'								LSD at—	
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'	0.05 level	0.01 level
LOUISIANA:											
Baton Rouge	14.6	90	114	105	101	110	100	. . .	. . .	NS	. . .
Bossier City	16.6	105	108	99	98	108	102	. . .	. . .	NS	. . .
Houma	13.5	65	104	102	99	114	104	. . .	. . .	6.8	9.3
MISSISSIPPI:											
Lorman	14.4	97	118	111	113	106	108	. . .	. . .	10.4	14.3
Meridian	13.0	114	117	108	115	113	123	. . .	. . .	10.5	14.3
Mississippi State	15.2	103	111	106	111	107	107	. . .	. . .	NS	. . .
Stoneville	15.5	84	108	103	95	108	104	. . .	. . .	13.1	NS
TEXAS:											
Weslaco	15.9	. . .	. . .	. . .	102	. . .	97	81	79	5.9	6.9
Mean	14.8	94	111	105	104	109	106	81	79	. . .	. . .

LSD Least significant difference. NS Not significant.

TABLE 4.—*Juice analysis: Purity*

Location	'Rio' (pct)	Pct of 'Rio'								LSD at—	
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'	0.05 level	0.01 level
LOUISIANA:											
Baton Rouge	76.4	96	101	100	91	104	98	...	...	NS	...
Bossier City	79.5	102	98	98	100	103	102	...	...	NS	...
Houma	76.2	82	100	97	95	100	98	...	...	5.6	7.7
MISSISSIPPI:											
Lorman	76.6	94	97	90	90	90	92	...	...	6.6	NS
Meridian	74.1	114	109	107	106	111	111	...	...	7.6	NS
Mississippi State	77.1	101	105	104	107	104	104	...	...	NS	...
Stoneville	76.0	90	101	100	94	103	102	...	...	7.4	NS
TEXAS:											
Weslaco	77.6	...	...	...	99	...	99	90	91	2.1	3.0
Mean	76.7	97	102	99	98	102	101	90	91	...	...

NS Not significant.

TABLE 5.—*Calculated sugar yield per ton of stalks*

Location	'Rio' (lb/ton)	Pct of 'Rio'							
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'
LOUISIANA:									
Baton Rouge	200	88	115	105	96	112	99	...	...
Bossier City	233	106	107	98	98	110	103	...	...
Houma	185	57	104	101	96	114	103	...	...
MISSISSIPPI:									
Lorman	198	94	116	103	105	98	102	...	...
Meridian	166	124	124	114	120	121	132	...	...
Mississippi State	209	103	114	109	115	109	109	...	...
Stoneville	211	78	109	103	92	110	105	...	...
TEXAS:									
Weslaco	220	...	...	...	101	...	97	76	74
Mean	203	93	113	105	103	110	106	76	74

TABLE 6.—*Calculated sugar yield per acre*

Location	'Rio' (lb/acre)	Pct of 'Rio'							
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'
LOUISIANA:									
Baton Rouge	4,538	84	115	96	72	128	93	...	...
Bossier City	2,792	133	110	73	59	104	88	...	...
Houma	2,234	68	92	95	68	136	86	...	...
MISSISSIPPI:									
Lorman	2,331	94	107	89	77	107	97	...	...
Meridian	3,974	137	132	98	78	134	116	...	...
Mississippi State	2,008	116	142	95	87	132	97	...	...
Stoneville	4,613	98	101	89	67	106	91	...	...
TEXAS:									
Weslaco	3,879	...	...	...	86	...	84	87	84
Mean	3,296	104	114	91	74	121	94	87	84

TABLE 7.—*Days from planting to harvest*

Location	'Rio' (standard)	Test variety							
		'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'
LOUISIANA:									
Baton Rouge	143	143	143	143	143	143	143	...	...
Bossier City	102	102	102	102	102	102	102	...	...
Houma	133	133	133	133	133	133	133	...	...
MISSISSIPPI:									
Lorman	155	155	132	132	132	132	132	...	...
Meridian	142	150	142	135	135	135	135	...	...
Mississippi State	139	139	139	139	139	139	139	...	...
Stoneville	127	127	127	127	127	127	127	...	...
TEXAS:									
Weslaco	83	...	...	...	83	...	83	83	83
Mean	128	136	131	130	124	130	124	83	83

TABLE 8.—*Diseases of economic importance in nine sweet sorghum sugar varieties*[1]

Location	'Rio' (standard)	Test variety 'Mer. 68-1'	'Mer. 68-2'	'Mer. 69-11'	'Mer. 69-12'	'Mer. 69-13'	'Mer. 69-15'	'Roma'	'Mer. 65-2'
LOUISIANA:									
Baton Rouge	GLS,ZLS	GLS,R	GLS,R	GLS,ZLS	GLS,R, BS	GLS	GLS,R	....	....
Bossier City	....	....	....	....	....	....	ZLS	....	....
Houma	GLS,ZLS	GLS,R, ZLS	R,ZLS	R,ZLS	GLS,R, ZLS	ZLS	GLS,ZLS	....	....
MISSISSIPPI:									
Lorman	GLS,RS	GLS,RS	....	GLS,RS	GLS,RS	ZLS,RS	GLS,RS	....	....
Meridian	GLS	RS	....	BS,ZLS	....	RS	RS	....	....
Mississippi State	....	....	....	....	....	....	....	....	....
Stoneville	....	....	....	BS	....	BS	GLS,R	....	....
TEXAS:									
Weslaco	GLS,INS	....	....	....	GLS,R	....	GLS,INS	INS	GLS,INS

[1] The presence of disease is indicated only when it was severe enough to have caused a reduction in yield or quality. BS Bacterial stripe. GLS Gray leaf spot. INS Insecticide injury. R Rust. RS Rough spot. ZLS Zonate leaf spot.